



Extreme temperature episodes and mortality in Yakutsk, East Siberia

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Abstract:

INTRODUCTION: Although the health impacts of heat waves and, to a lesser extent, cold spells in big cities in moderate climates have been well documented, little is known about the same impacts in the circumpolar region. An epidemiological study in an Arctic town presents considerable difficulties for the statistician because of small population sizes. When daily mortality counts are mostly 0, 1 or 2, they are not normally distributed and do not fit the independence assumption. The aim of this study was to take these difficulties into account and assess the impacts of extreme temperature events on mortality rates in Yakutsk, a city with a strongly continental climate, situated near the north pole. **METHOD:** Long-term distributions of daily mean temperatures were analyzed for identification of heat waves and cold spells during the study period of 1999 to 2007. The authors investigated daily mortality from all non-accidental causes, coronary heart disease and cerebrovascular causes among the age groups 30-64 years and 65 years and over. Statistical analysis was in two steps. Step 1 involved Student's t-tests of samples, which consisted of cumulative mortalities during each heat wave. This provided a measure of the average health effect of all identified heat waves, and the same analysis was performed separately for cold spells. At Step 2, the authors compared the observed cumulative mortality during each individual temperature wave with expected seasonal mortality, using chi(2) tests. **RESULTS:** The analysis of the impacts of six heat waves and three cold spells provided sufficient evidence that cardiovascular and non-accidental mortalities increased in Yakutsk during both heat waves and cold spells. The magnitude of established health effects was approximately the same for heat and cold. No significant differences were found between the two analyzed age groups in terms of relative excess mortality. Coronary heart disease mortality increased more than two-fold during some of the identified temperature waves, while non-accidental mortality increased by approximately 50%. The time lags between the temperature wave and observed increase in mortality varied between 8 and 14 days, which indicated that the health effects of temperature extremes were delayed rather than immediate. The evidence obtained of the effects of temperature waves on cerebrovascular mortality was not conclusive. Addressing the methodological implications of dealing with small cities, the authors linked the sensitivity of the applied statistical tests to arithmetic means and relative standard deviations of daily death counts, and to the duration of temperature waves. **CONCLUSIONS:** The proposed methodology can be applied in other medium-sized towns (populations >200,000, approximately); however, only large relative increases in mortality will be statistically significant. For example, relative risks of less than 2.0 for coronary disease mortality and 1.4 for non-accidental mortality are likely to be non-significant.

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Resource Description

Exposure : ☑

Climate Change and Human Health Literature Portal



weather or climate related pathway by which climate change affects health

Temperature

Temperature: Extreme Cold, Extreme Heat

Geographic Feature:

resource focuses on specific type of geography

Arctic

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: Russia

Health Impact:

specification of health effect or disease related to climate change exposure

Cardiovascular Effect, Injury

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Population of Concern: A focus of content

Population of Concern:

populations at particular risk or vulnerability to climate change impacts

Elderly

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content

